UNPUBLISHED
SURVEY & CONTROL
REPORT

INTERMOUNTAIN STATION
Central Reference File
No. 2-4163-8/

Bureau of
Entomology & Plant Quarantine
RECEIVED
JUL 6 1953
Coeur d'Alene, Ida.
Laboratory

WORK PLAN TO EVALUATE MORTALITY IN DOUGLAS FIR BY AERIAL PHOTOGRAPHY AND AERIAL STRIP COUNTING TECHNIQUES

By

P. G. Lauterbach, Research Forester
Weyerhaeuser Timber Company
and
J. F. Wear, Forester-Pilot
Bureau of Entomology & Plant Quarantine
U. S. Department of Agriculture

Forest Research Center
Weyerhaeuser Timber Company
Centralia, Washington
June 1, 1953

FILE COPY
MISSOULA
FOREST INSECT
LABORATORY

June 1, 1953

WORK PLAN TO EVALUATE MORTALITY IN DOUGLAS FIR BY AERIAL PHOTOGRAPHY AND AERIAL STRIP COUNTING TECHNIQUES

JUSTIFICATION

Aerial surveys are a rapid and economical means for detecting and evaluating outbreaks of some kinds of forest insects. The aerial sketch mapping of outbreaks of such insects as the spruce budworm is an important part of the annual survey of insect conditions in Oregon and Washington. Aerial strip counting and aerial photography offer opportunities for further improvements in making forest insect surveys and in measuring tree mortality due to other causes.

Preliminary studies of the strip counting and aerial photographic methods applied to Douglas fir stands have been promising. The findings have been inconclusive because mortality on the study areas was light. Not enough men have been available to do the necessary ground checking. Now it is desirable to test these two methods under epidemic conditions on an area where the selected plots can be ground-checked, photographed, and strip-counted annually for several years.

The Millicoma Tree Farm in southwestern Oregon provides an ideal study area. Heavy mortality due to bark beetles, root rot and windthrow is present and widely distributed. Detailed studies of these mortality factors already are in progress. Permanent sample plots, suitable for photographing and strip counting, were established and inventoried in 1952. These plots will be recruised annually. Manpower is available to evaluate the ground and aerial survey methods.

In view of the above considerations the present study is undertaken as a cooperative venture by Weyerhaeuser Timber Company and the U. S. Bureau of Entomology and Plant Quarantine. The objectives, methods and nature of the cooperation are outlined in the following work plan.

OBJECTIVES

The principal objectives of this study are as follows:

1. To determine the accuracy of aerial color photography, aerial black and white photography, and aerial strip viewing for estimating tree mortality from all causes.

2. To determine the relative costs and efficiency of the three sampling methods.

3. To determine whether the accuracy standards, costs, and efficiency of the aerial methods are sufficiently favorable to replace ground sampling methods.

4. To determine the size and shape of plot that is most efficient for estimating mortality.

5. To develop a survey method for recording and evaluating various kinds of insect infestations, and for locating and measuring total annual mortality over large areas.

6. Answers to the above objectives will be derived from both inspection and statistical analysis of the data collected and tabulated in summary tables, as shown at the end of this work plan.

PLAN OF WORK

1. Description of Sample Plots

Eight permanent sample plots were established in 1952 on the Millicoma Forest in Coos County, Oregon. The plots were grouped in an area known to have generally heavy mortality. In order to minimize bias, the actual locations of the plots were selected from contour maps in the office before field inspection. The basis for selection was as follows:

a. The start and finish of the plots were to be near roads.

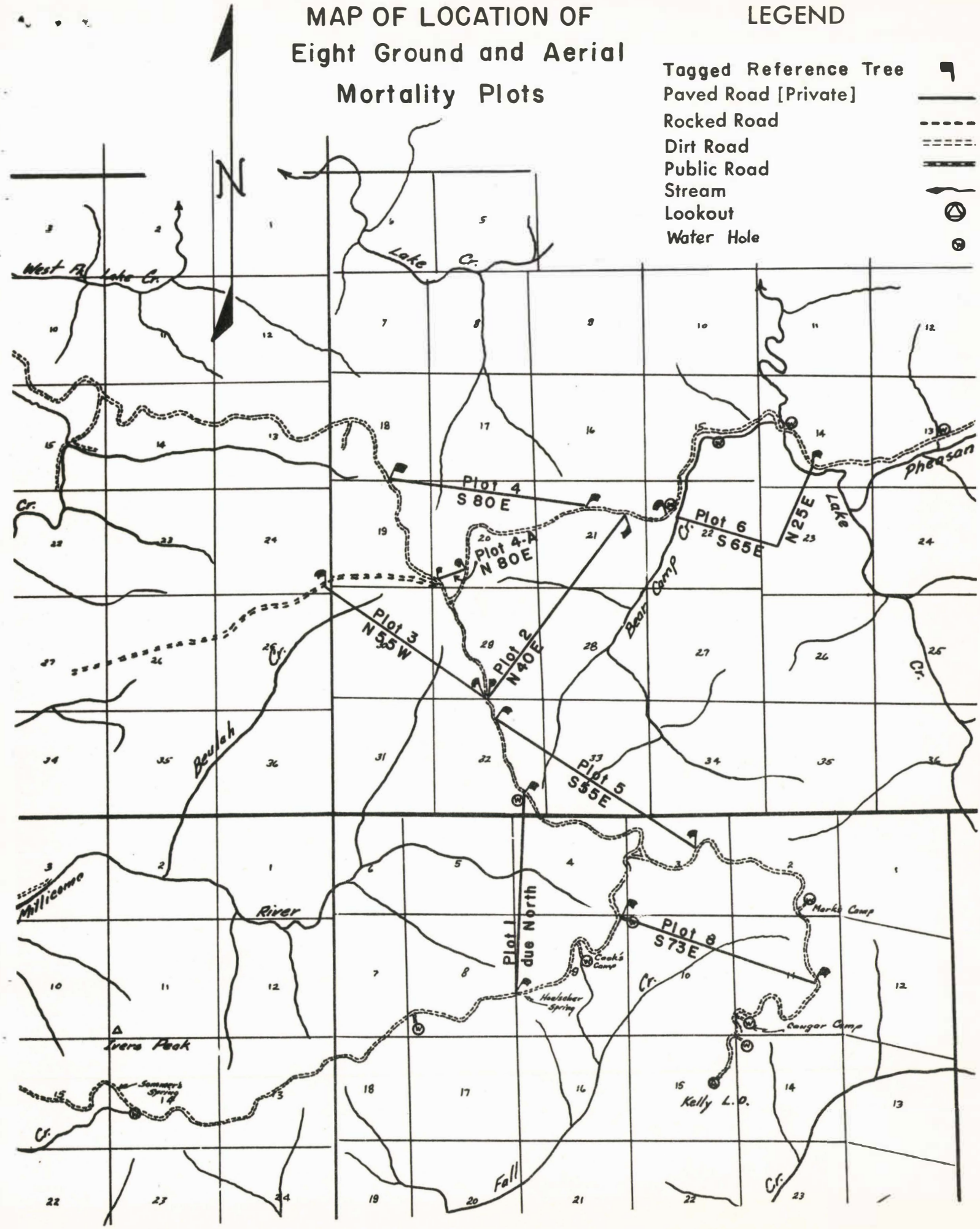
b. The plots were to be two chains wide and approximately two miles long.

c. The plots were to cross the topography rather than follow creeks or ridges.

d. The plots were to be located in areas not scheduled for early logging.

The locations of these plots are shown on the attached one-inch = one mile planimetric map. The center line of the plot was established by staff compass and chain. Permanent hub markers, referenced to standing trees, were established at five-chain intervals, and profile data were collected by means of topographic abney and chain in feet above sea level. This will aid in determining the scale of aerial photography and width of strip on aerial strip counts.

MAP OF LOCATION OF Eight Ground and Aerial Mortality Plots



Following are the description of plot length, bearing, and elevation for the eight plots.

Line No.	Distance (tallies)	Plot Bearing	Elevation in feet above sealevel. Start of Line	Est. Ave. of Line	Finish of Line	Highest Point	Lowest Point
1	27.0	Due N.	2100	1450	1540	2100	1100
2	30.6	N 40° E	1750	1600	1260	1830	1140
3	26.4	N 55° W	1750	1550	1640	1790	1270
4	27.0	S 80° E	1450	950	980	1450	640
4A	6.0	N 80° E	1750	1600	1760	1760	1400
5	35.0	S 55° E	1640	1500	1920	1920	1230
6	16.0 +17.0	S 65° E N 25° E	710	1050	750	1410	680
8	32.0	S 73° E	2210	1700	2030	2250	1000

All eight plots were 100 percent ground-cruised in 1952 with every dead standing and down tree plotted in place. A record was made of cause and year of kill of all trees that had died since 1949. These permanent plots will be ground-cruised each year to determine current mortality.

2. Aerial Photography

Large-scale aerial photographs, approximately 1/6000 scale, will be taken of each plot. This scale of photography was selected on the basis of preliminary findings from the Coos-Josephine study, an aerial survey experiment performed in 1949-50. All aerial photo coverage will be duplicated with Ektachrome color film and Super XX panchromatic film with orange G. filter. At this scale nine exposures will provide 60 percent stereo coverage for a two-mile strip. One 75-foot roll of each kind of film should be ample to cover the eight plots one time.

Practically all of the trees that were killed by insects in 1952 will have faded by July 1953. Early in August some of the trees attacked in 1953 will begin to fade. In order to keep the loss record separate by years, the aerial phases of this study are scheduled for July 12-18, 1953. It is estimated that the eight plots can be photographed twice in one good day of photographic weather due to the close proximity of plots to each other.

The type of plot marker best suited for identifying aerial mortality plots will be determined in June by conducting a series of tests described in another work plan. All plots will be marked in accordance with results and recommendations of this study.

The films and prints will be processed in the Portland Forest Insect Laboratory darkroom immediately after photography. Field checking of mortality with the photographs will be started as soon as the prints are processed to minimize foliage loss or new fading following the photography.

The photo pilot's record form and photographer's record form shall be completed as soon as each strip is flown, (See attached form) .

3. Field Checking

A set of black and white prints made from the panchromatic film will be used for field checking the mortality. Another set will be prepared for photo interpretation in the office. The field data will be recorded on the Mortality Evaluation Form (see attached example). Part of the data obtained will be for the ground studies for which the eight plots were originally established and will not be utilized in this proposed study. However since it is advisable to collect the data at this time, they are included in these instructions.

Following are the instructions for recording the field data on the mortality forms and photographs:

A. On the Mortality Forms

(a) Enter plot number and location, date of photography, date of field examination, field examiners, field recorder, and aerial photo annotator on the form headings.

(b) Record the tally number (five-chain intervals) in which the dead tree occurs. Mortality occuring in first five-chain of the plot will be recorded in tally 1, etc.

(c) Assign a number, in numerical sequence, prefaced with year of death, to all standing dead trees, windbroken trees, and windthrown trees on the plots. (Example: 52-1 will be first tree that died in 1952 on each plot). Since this was done in September, 1952, only mortality since that time need be recorded.

(d) Diameter-breast height will be measured with diameter tape and recorded by two-inch diameter classes.

(e) Tree species will be recorded by appropriate abbreviations. DF = Douglas fir, H = hemlock, WF = white fir.

(f) Site Class will be estimated for each tree tallied.

(g) The elevation of each tree above sea level (to the nearest 100 feet) will be determined in the office at the completion of the field examination.

(h) Position on the slope of each tree will be recorded by appropriate symbols:

Symbol	Description
R	Ridge top
U	Upper one-third of hill
M	Middle one-third of hill
L	Lower one-third of hill
B	Creek bottom

(i) Slope will be recorded by following symbols:

Symbol	Description	Percent Slope
L	Level	0 - 10
R	Rolling	11 - 25
M	Moderate	26 - 40
S	Steep	41 - 80
VS	Very steep	81+

(j) Aspect will be recorded in eight compass directions.

(k) Crown Class will be recorded for each tree tallied. The symbols D, C, I, S will be used to denote dominant, codominant, intermediate, and suppressed trees respectively.

(l) The amount of foliage remaining (on standing dead trees only) will be entered in the crown foliage column by the following standards:

Symbol	Description
N	Less than 10 percent of original foliage present.
F	10 to 50 percent of original foliage present.
A	51 to 100 percent of original foliage present.
TK	Top-kill only - tree alive.

(m) The foliage color will be entered for all trees with 10 percent or more of crown foliage by following symbols:

Symbol	Color
Y	Straw yellow
R	Red
B	Brown

(n) Position of tree will be described as follows:

Symbol	Description
S	Standing
WB	Windbroken above 16 feet
WT	Windthrown or windbroken under 16 feet.

(o) Cause of Death. The primary and, when present, the secondary cause of mortality will be recorded by the following symbols:

Symbol	Cause of Mortality
I	Insects
D	Disease
F	Fire
WT	Windthrow
WB	Windbreak or snowbreak
LT	Lightning
S	Suppression
L	Logging damage
RC	Road construction
U	Unknown

The primary mortality cause symbol will precede the secondary cause, with a dash (-) between them, i. e., D-WT, S-I, I-D.

(p) When insects are either a primary or secondary cause of tree death, the insect species will be recorded:

Symbol	Insect
Dp	Dendroctonus pseudotsugae
O	Others - specify in remarks column

(q) When disease is present, its species will be noted:

Symbol	Disease
Pw	Poria weirii
Fp	Fomes pini
Ps	Polyporus schweintzii

(r) The year mortality occurs will be tallied as follows:

(1) Trees killed by insects, fire, lightning, logging damage, or road construction will be dated as of the year in which the event responsible for the mortality took place.

(2) Trees killed by disease, suppression, or unknown will be dated as of the year in which complete mortality is first noted.

(3) Trees killed by windthrow, windbreak, or snowbreak will be dated as of the year following the winter in which it occurred, i.e., trees windthrown in the winter of 1952-53 will be recorded as 1953 mortality.

(4) Where more than one cause is responsible for the mortality, the primary cause will be listed first and dated corresponding to that category.

(s) Volume in Scribner board feet will be computed from a local volume table constructed for these stands, using d.b.h. and site. This will be done in the office within two weeks after completion of the field examination.

In addition, location of dead trees will be mapped on graph paper on scale of one-half inch = one chain.

B. On the Photographs

(a) Each standing dead and down tree within the plot on the overlapping photographs will be annotated with red pencil. As each tree is circled, a red line is drawn from the circle beyond the edge of the plot, and the field number is recorded.

(b) At 20 chain intervals along the edge of the photo plot the photographs will be pin pricked. These marks will outline the boundaries of the plot and subdivide the plot for statistical analysis.

(c) The center of the photo strip will be pin pricked at five-chain intervals.

4. Interpretation of Photographs

A set of panchromatic photographs and color prints on which only the plot center line tally markers and plot boundaries are annotated will be used for office photo interpretation. Photo interpretations by two of the four interpreters will be performed as soon as ground checking with photographs is completed and plot center line markers and plot boundaries annotated. It is intended this phase will follow field checking closely and not await completion of field examination of all plots. Photo interpretation by the other two interpreters will be done in September or October.

The following procedures will be used for interpretation and recording data of mortality on the photographs. A sample form is attached to tabulate and summarize this information.

(a) Stereo interpretation of panchromatic photographs for each plot will be performed using 3X magnification pocket stereoscopes. For comparable interpretation results, 3X magnification should also be used for color transparencies. Either 3X pocket stereoscope over a split light table or a magnifying mirror stereoscope over a standard light table should be used.

(b) Mortality should be interpreted on all plots on panchromatic photos before interpreting any of the color photos. An interval of several days should be taken between panchromatic and color interpretation to prevent bias.

(c) Use separate plot tally sheets (Photo Interpretation Form) for interpretation of panchromatic and color photos.

(d) In interpretation, follow the same directions as the cruise was run in the field.

(e) Interpret and tally all trees that have died since 1949 on the two-chain strip outlined on the series of overlapping photographs. Annotate each dead tree with a numbered dot or circle in red pencil and assign a tree number in sequence for each plot on the transparent overlay. Marking tree positions on the transparent overlay will keep the photographs clean for other interpreters and will assist in checking and comparing interpretation results.

Following are the instructions for recording the office photo interpretation for each dead tree. A sample form is attached.

(1) Record the tally and segment number in which each dead tree is located.

(2) Assign an office number in sequence for each dead tree found.

(3) Tree species entered by appropriate: DF - Douglas fir, H - hemlock, WF - white fir.

(4) Position of dead tree: S - standing, D - down (windthrown or wind and snowbroken)

(5) Cause of standing tree mortality: For each standing dead tree, estimate cause of mortality. Use same symbols given for field tally.

(6) Year of mortality: post-date standing mortality by year of kill:

a. Killed in 1952

b. Killed in 1950 and 1951

(f) After an interpreter completes interpretations of both panchromatic and color photos for a plot, he will refer to the field set of panchromatic photos on which dead trees have been annotated in the field. Dead trees interpreted on the color and panchromatic photographs in the office should be checked stereoscopically with field annotated photograph and field number recorded on the photo interpretation form. He should also list field identifying and supplementary data for each dead tree interpreted (i.e., crown class, color of foliage and amount of foliage remaining, gross Scribner board foot volume, and remarks, if any). In addition, a list of all dead trees annotated on the field photos but not interpreted on the photographs, should be listed in appropriate columns along with field identifying data. These data, plus field checks of photo interpretations by two interpreters, will serve as a guide for analyzation of all interpreters.

5. Aerial Strip Counting

The aerial strip counting test will be conducted as soon as possibil after the aerial photography is completed. The counting will be done from the Portland Forest Insect Laboratory's Cessna 170B airplane equipped with a radio altimeter and a revised aerial strip viewer. The aerial strip viewer is adevice mounted in the floor of the plane through which an observer looks vertically at a strip on the ground to count dead trees. Aerial strip counts will be made over each plot to compare accuracy and efficiency with ground and aerial photographic sampling.

The plot markers used for the photographic tests will be helpful in flying over the eight plots. It is not expected that exact duplication of ground plots can be achieved. The Forest Insect Laboratory will provide one estimator and Weyerhaeuser Timber Company will provide three for replicated tests of the strip viewing technique.

Average flight altitudes across each plot for the aerial strip counting technique will be approximately 800 feet above the forest canopy. Since variations in terrain will affect each observer's strip width, the altitude above the terrain on the radio altimeter

dial indicator will be recorded. This will be done so the actual area surveyed can be determined.

The strip counting tests will be flown near the middle of the day to take advantage of shortest tree shadows and greatest illumination of tree crowns. The four replicated observations should be made across each plot under the same conditions and as close to the same time as is practicable. The Aerial Strip Count Forms will be filled out by each observer with complete detail.

6. Plan of Study for Evaluation of Shape and Size of Mortality Plots.

No detailed working plan will be made at this time for evaluating efficiency and accuracy of various numbers, sizes and shapes of mortality plots. However, if reasonably accurate mortality evaluations can be made on the aerial photographs, tests should be made of various size and shapes of plots from the effective one-quarter mile photographic width. This should be done on the type of aerial photo (color or panchromatic) which is found in this study to be the most accurate and efficient. Plots from one-quarter or one-fifth acre square, rectangular or circular plots to 320 acre rectangular plots will be possible from each two-mile long plots..

If sufficiently accurate mortality determinations are possible from aerial photographs, a detailed cooperative work plan will be prepared after completion of the other phases of the study outlined in this work plan.

7. Development of Methods for Locating and Measuring Total Annual Mortality for Large Areas, and Recording and Evaluating Trends of Insect Infestation.

One of the objectives of this study is the development of a method for locating and measuring total annual mortality for large areas and recording and evaluating trends of insect infestations. Data collected from these eight plots will be utilized for this purpose. Answers to objectives 1, 2, 3 and 4 will aid materially in designing a suitable mortality survey plan for large areas. Trends of mortality have been obtained since 1946 on the access roadside mortality strip (partially abandoned in 1952 and 1953), since 1949 on the growth and mortality plots, and since 1952 on the eight cross country plots. However, these studies have been confined to areas accessible by roads and have necessarily been confined to a small part of the Millicoma Forest

It is planned to continue these plots until they are disturbed by logging or road building.

Aerial survey techniques, if found to be accurate and efficient, will permit more rapid development into areas without suitable roads, and permit more accurate determination for locating and measuring total annual mortality and recording and evaluating trends of insect infestation. The information developed on the Millicoma Forest is expected to have wide application in the Douglas Fir Region.

8. Summarization of Results

At the completion of the photographic interpretation, summarization of photo and strip viewing data and analyzation of the results, a joint progress report will be prepared by December 1953.

9. Plans for Future Work

Some of the objectives in this work plan will take more than one year to attain. Several phases of the work require replication in 1954 and may be continued for several years for the following reasons:

(a) In previous studies, the difficulty and poor accuracy of obtaining windthrown and windbreak mortality from one set of aerial photographs have been demonstrated. Repeat photography offers a promising yet untested method of comparing photographs to find missing trees.

(b) One problem of aerial mortality techniques will be to provide a base for identifying new mortality from past mortality. Separation may be possible by use of outward characteristics of amount of foliage and small twigs remaining, but it will be difficult to differentiate between recent years' insect mortality. Possibly, by reference to mortality interpreted on previous photographs, only current mortality need be tallied. It may be necessary, however, to identify all mortality, and deduct it from the previous total. A test of these techniques will be made to determine the most satisfactory method of determining amount of new mortality from one or more sets of repeat photographs.

(c) Differences due to the amount and cause of mortality, the time of survey, and various survey conditions may affect the accuracy of the survey. Repeat photography will be tested to determine its applicability under varying conditions.

COOPERATION

Aerial Photography

			COST or MAN DAYS
AIR PERSONNEL			
Photo Pilot	J. F. Wear	B.E.P.Q.	1
Aerial Photographer		PNW For. Exp. Sta.	3
GROUND PERSONNEL			
Two 4-man crews to check mortality plots		WTCo.	32
Darkroom specialist	J. E. King	WTCo.	5
Darkroom supervision	J. F. Wear	B.E.P.Q.	1
Photo interpreters	J. F. Wear	B.E.P.Q.	4
	A. V. Smyth	WTCo.	4
	J. E. King	WTCo.	4
	P. G. Lauterbach	WTCo.	4
Plot marker installation		WTCo.	10
MATERIALS			
Color film and chemicals (1 roll, 75'/9")		WTCo.	$160.00
Super XX Aero Pan and chemicals		WTCo.	45.00
Paper and chemicals for printing (300 sheets)		WTCo.	15.00
Forms, etc.		WTCo.	100.00
Use of field equipment for ground mortality crew		WTCo.	
Use of Cessna 170B airplane		B.E.P.Q.	
Use of K-17 12" aerial camera and aerial photo equipment		B.E.P.Q.	
Darkroom and processing facilities for color and black and white		B.E.P.Q.	
Plot marking			100.00

Aerial Strip Counting

AIR PERSONNEL			
Pilot	J. F. Wear	B.E.P.Q.	2
Observer-recorder	K. H. Wright	B.E.P.Q.	1
Observer-recorder	P. G. Lauterbach	WTCo.	1
Observer-recorder	A. V. Smyth	WTCo.	1
Observer-recorder	V. F. McCowan	WTCo.	1
GROUND PERSONNEL			
Computer	P. G. Lauterbach	WTCo.	2
MATERIALS			
Use of plane equipped with radio altimeter		B.E.P.Q	100.00
Use of aerial strip viewer for 13" x 18" hatch		B.E.P.Q.	
Use of intervalometer		B.E.P.Q.	
Use of tally registers		B.E.P.Q.	
Forms for recording data		WTCo.	10.00
Plot marking		WTCo.	100.00

Cooperative Report

PERSONNEL	J. F. Wear	B.E.P.Q.	20
	P. G. Lauterbach	WTCo.	20
Total	Man days		40
	Costs		$780.00

FORM A

Sheet__ of___

PHOTO INTERPRETATION FORM

1953 Millicoma Forest Aerial Technique Study

Plot No._____ Film_____ Interpreter_____

Date Photographed_____ Date(s) Field Examined_____ Date Interpreted_____

Trees Interpreted											Trees Missed								
Tally and Segment No.	Tree No.	Position	Year of Death	Field Tree No.	Cause of Mortality	Crown Class	Color of Fol.	Amt. of Fol.	Species	Remarks	Scribner Bd Ft Vol.	Tree No.	Position	Year of Death	Cause of Mortality	Crown Class	Color of Fol.	Amt. of Fol.	Species	Scribner Bd. Ft. Vol.

FORM B

Sheet ___ of ___

PHOTOGRAPHER'S RECORD

1953 Millicoma Forest Aerial Mortality Technique Study

Photographer _____ Pilot _____

Camera _____ Film _____ Ft. Roll _____ No. Exp. _____

Scale _____

Av. Air Speed _____ Sec. Interval _____ Percent Overlap _____ No. Exp. _____

Plot No.	Date	Meter Read.	Filter and Factor	Camera Setting		No. Exp.	Drift	Time	Mag. Count Read.
				Speed	Aperature				

Sheet____ of____

PILOT'S RECORD

1953 Millicoma Forest Aerial Mortality Technique Study

Pilot_____ Photographer_____

Camera_____ Film_____ Ft. Roll_____ No. Exp._____

Scale_____

Ave. Air Speed_____ Sec. Interval_____ Percent Overlap_____ No. Expo._____

Plot No.	Date	Filter	Indicated Air Speed	True Air Speed	Temp. T.A.S.	True Altitude	Flight Direction	Weather

FORM D -

Sheet____ of____

AERIAL STRIP COUNT FORM

Forest_____ Area_____

Plot No._____ Date_____

Observer_____ Recorder_____ Pilot_____

Measured Length of Strip_____ Datum_____

Strip Width_____ Flight Altitude_____

Time: Start_____ Stop_____ Total_____

Forest Type_____ Age_____

Segment Number	Length	Average Flight Ht. Above Grid	NUMBER OF TREES					
			195		195		Other	
			Down	Standing	Down	Standing	Down	Standing

FORM [illegible]

Sheet____of___

SUMMARY TABLE NO. 1

Comparison of Aerial and Ground Estimates of Number of Dead Trees

Plot No.	Segment Number	Number Acres	Actual No. Dead Trees (Ground Cruise)	Panchromatic Photo Estimate Interpreters A	B	C	D	Color Photo Estimate Interpreters A	B	C	D	Strip Count Estimate Observers A	B	C	D
1	1	8													
	2	8													
	3	8													
	4	3.													
2	1	8													
	2	8.													
	3	8													
	4	6.6													
3	1	8													
	2	8													
	3	8													
	4	2.4													
4	1	8													
	2	8													
	3	8													
	4	3													
4A	1	6													
5	1	8													
	2	8													
	3	8													
	4	8													
	5	3													
6	1	8													
	2	8													
	3	8													
	4	9													
8	1	8													
	2	8													
	3	8													
	4	8													
TOTALS															

FORM [illegible]

SUMMARY TABLE NO. 2

Comparison of Differences in Dead Tree Counts Between Ground and Aerial Estimates

Plot No.	Segment Number	No. Acres	Panchromatic Aerial Photography (Actual - Estimated) A	B	C	D	Color Aerial Photography (Actual - Estimated) A	B	C	D	Aerial Strip Counting (Actual-Estimated) A	B	C	D
1	1	8												
	2	8												
	3	8												
	4	3												
2	1	8												
	2	8												
	3	8												
	4	6.6												
3	1	8												
	2	8												
	3	8												
	4	2.4												
	1	8												
	2	8												
	3	8												
	4	3												
4A	1	6												
5	1	8												
	2	8												
	3	8												
	4	8												
	5	3												
6	1	8												
	2	8												
	3	8												
	4	9												
8	1	8												
	2	8												
	3	8												
	4	8												
AVERAGE DIFFERENCES														

FORM G .

SUMMARY TABLE NO. 3

Comparison of Costs of Ground and Aerial Methods

Plot No.	No. Acres	Ground Cruise Costs			Panchromatic Photography Costs			Color Photography Costs			Strip Count Costs		
		Man Days	Material & Equip. Costs	Total Cost	Man Days	Mat.& Equip. Costs	Total Cost	Man Days	Mat.& Equip. Costs	Total Cost	Man Days	Mat.& Equip. Costs	Total Cost
1	27.0												
2	30.6												
3	26.4												
4	27.0												
4A	6.0												
5	35.0												
6	33.0												
8	32.0												
TOTALS													

FORM H

SUMMARY TABLE NO. 4

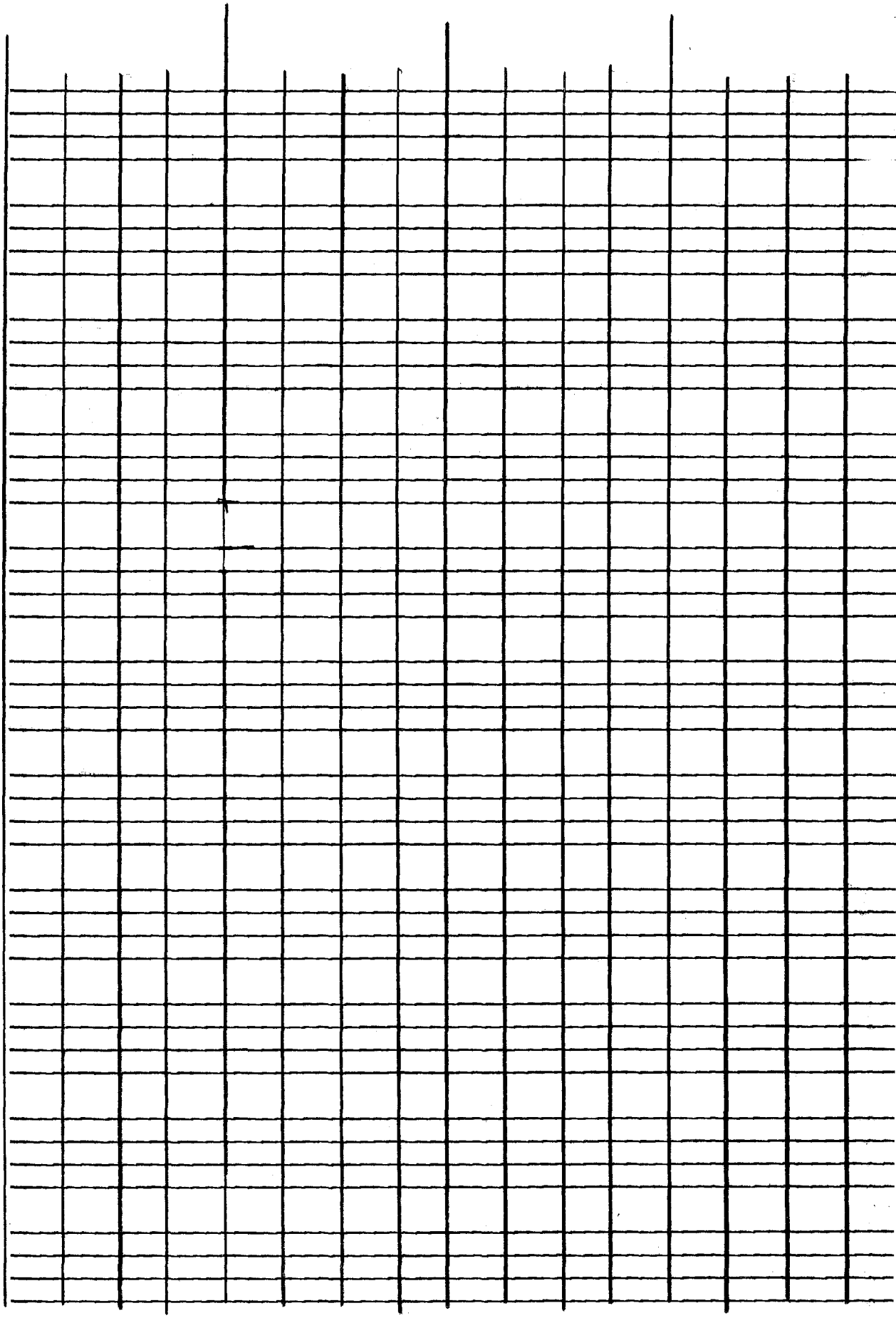
Crown Class of Standing Dead Trees

Crown Class - Standing Dead Trees

Plot	Segment	Observer or Interp.	Ground Survey Data								Panchromatic Photo Interp.								Color Photo Interp.								Strip Count Data							
			D		C		I		S		D		C		I		S		D		C		I		S		D		C		I		S	
			N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	1	A																														
		B																														
		C																														
		D																														
	2	A																														
		B																														
		C																														
		D																														
	3	A																														
		B																														
		C																														
		D																														
	4	A																														
		B																														
		C																														
		D																														
2	1	A																														
		B																														
		C																														
		D																														
	2	A																														
		B																														
		C																														
		D																														
	3	A																														
		B																														
		C																														
		D																														
	4	A																														
		B																														
		C																														
		D																														
3	1	A																														
		B																														
		C																														
		D																														

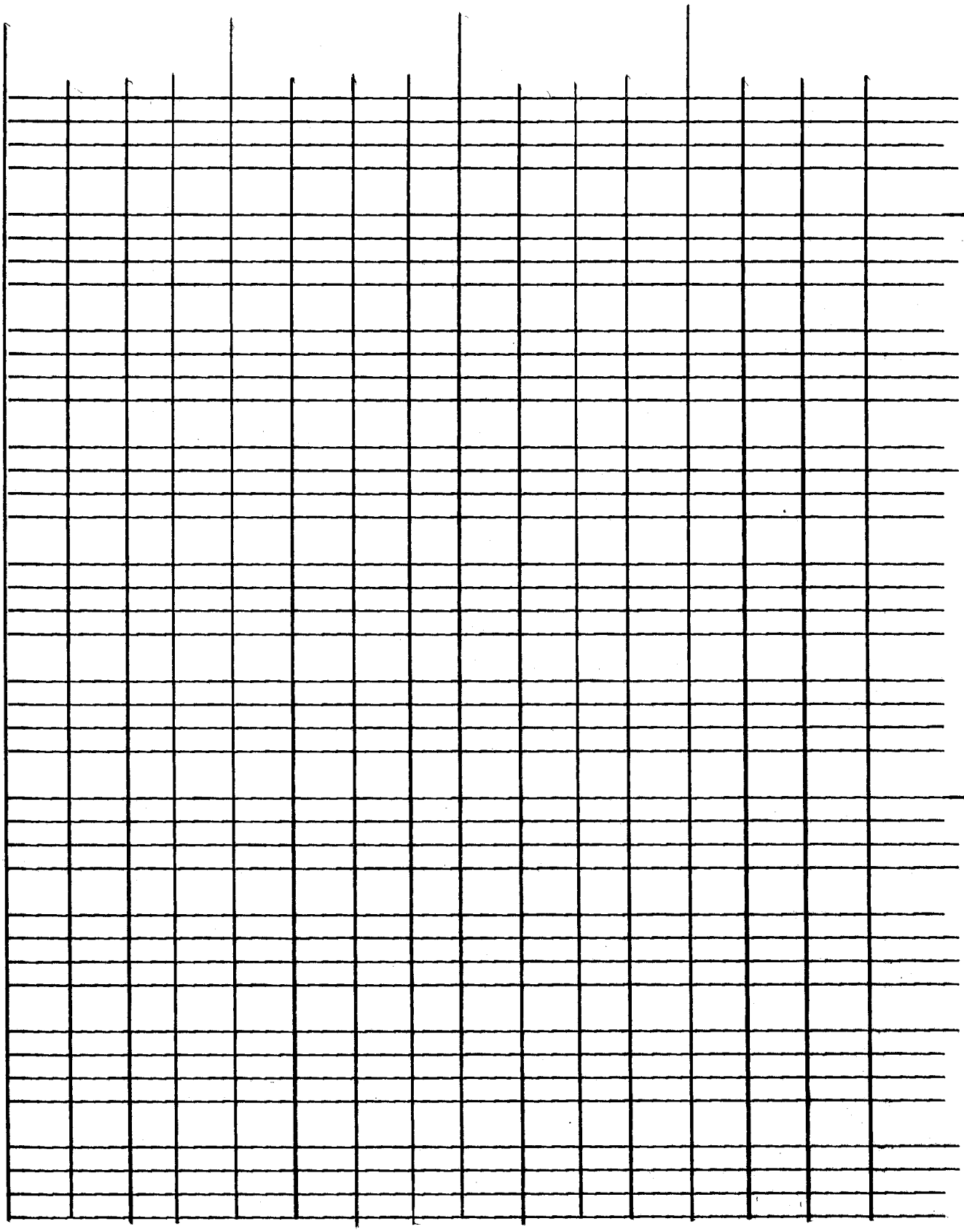
FORM H-2

3	2	A B C D
	3	A B C D
	4	A B C D
4	1	A B C D
	2	A B C D
	3	A B C D
	4	A B C D
4A	1	A B C D
5	1	A B C D
	2	A B C D
	3	A B C D



FORM H-3

5	4	A B C D
	5	A B C D
6	1	A B C D
	2	A B C D
	3	A B C D
	4	A B C D
8	1	A B C D
	2	A B C D
	3	A B C D
	4	A B C D



FORM I.

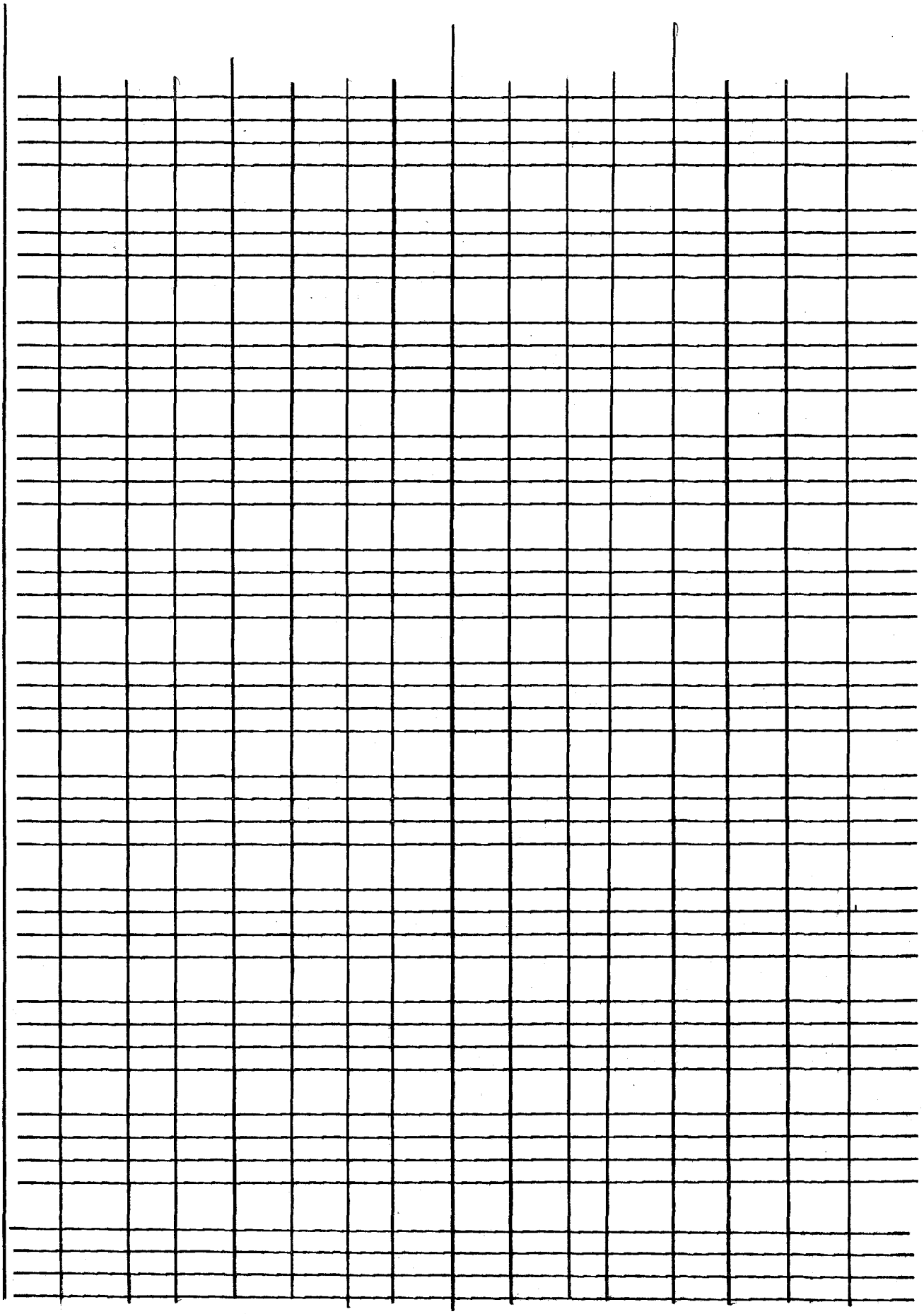
SUMMARY TABLE NO. 5

Amount of Foliage Remaining on Standing Dead Trees

Plot	Segment	Observer or Interp.	Amount of Foliage Remaining															
			Ground Survey Data				Panchromatic Photo Interp.				Color Photo Interp.				Strip Count Data			
			N	F	A	TK	N	F	A	TK	N	F	A	TK	N	F	A	TK
			N %	N %	N %	N %	N %	N %	N %	N %	N %	N %	N %	N %	N %	N %	N %	N %
1	1	A																
		B																
		C																
		D																
	2	A																
		B																
		C																
		D																
	3	A																
		B																
		C																
		D																
	4	A																
		B																
		C																
		D																
2	1	A																
		B																
		C																
		D																
	2	A																
		B																
		C																
		D																
	3	A																
		B																
		C																
		D																
	4	A																
		B																
		C																
		D																
3	1	A																
		B																
		C																
		D																

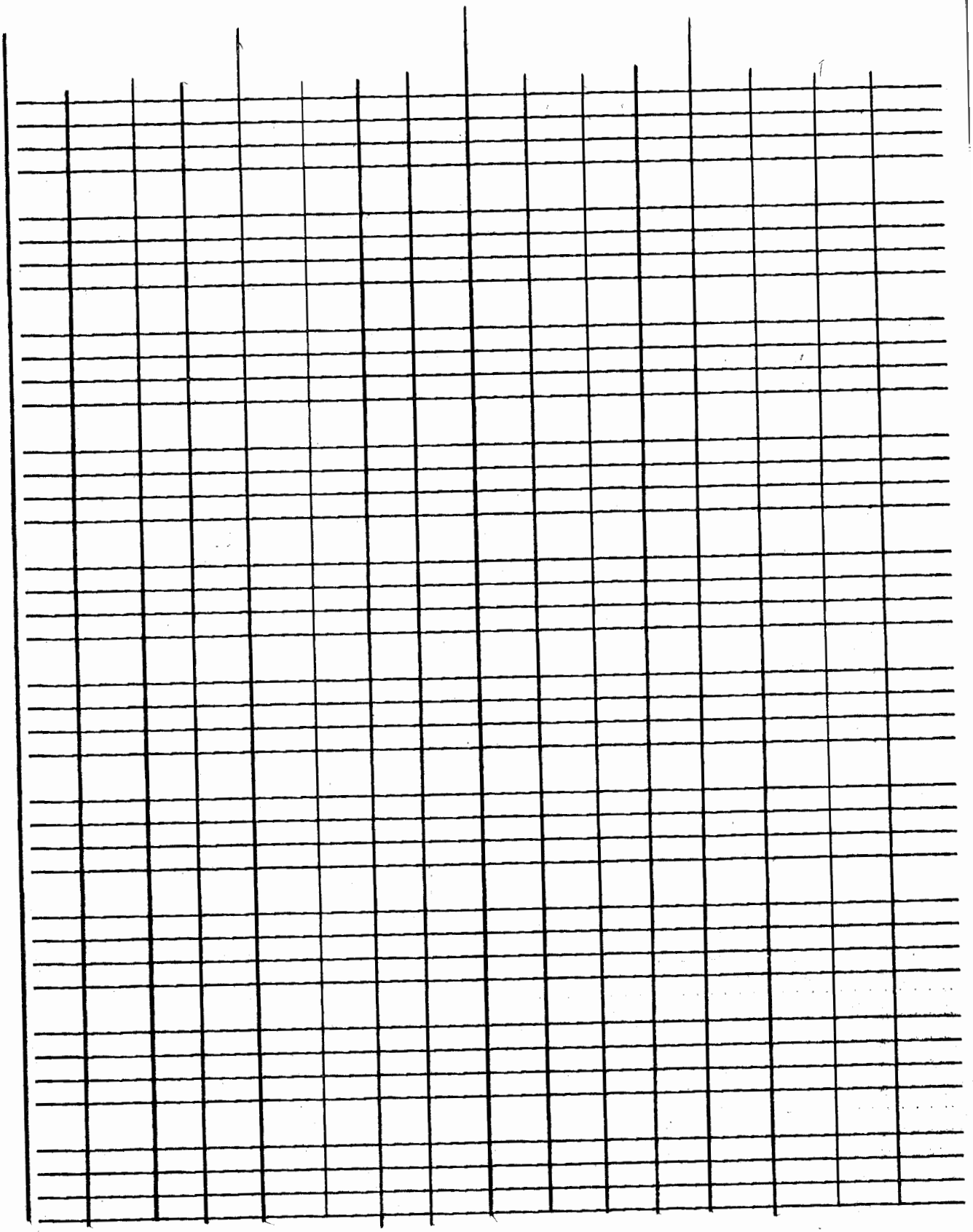
FORM I-2

3	2	A B C D
	3	A B C D
	4	A B C D
4	1	A B C D
	2	A B C D
	3	A B C D
	4	A B C D
4A	1	A B C D
5	1	A B C D
	2	A B C D
	3	A B C D



FORM I-3

5	4	A B C D
	5	A B C D
6	1	A B C D
	2	A B C D
	3	A B C D
	4	A B C D
8	1	A B C D
	2	A B C D
	3	A B C D
	4	A B C D



FORM 3.

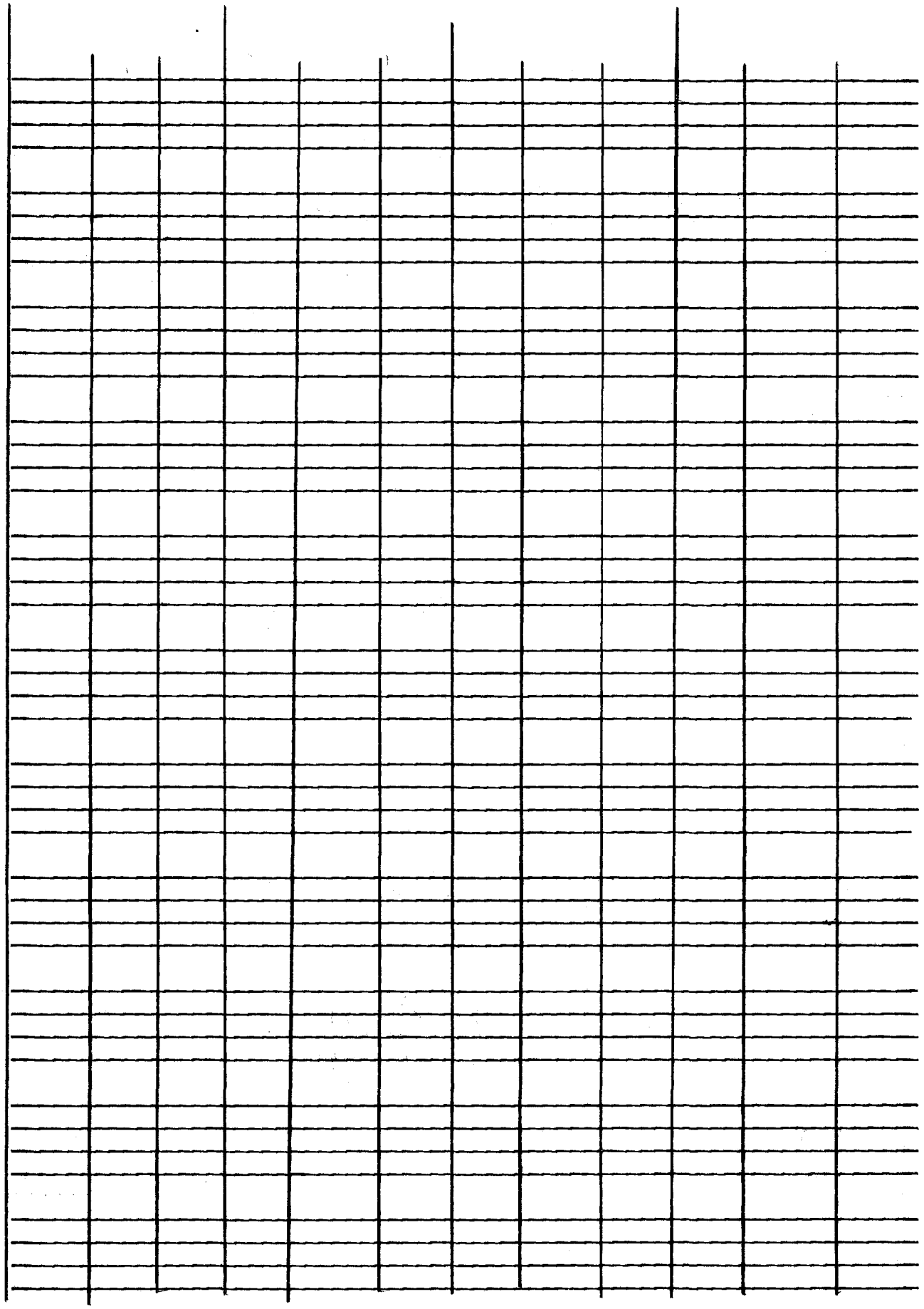
SUMMARY TABLE NO. 6

Color of Foliage Remaining on Standing Dead Trees

Plot	Segment	Obser. or Interp.	Color of Remaining Foliage											
			Ground Survey Data			Panchromatic Photo Interp.			Color Photo Interp.			Strip Count Data		
			Y N %	R N %	B N %	Y N %	R N %	B N %	Y N %	R N %	B N %	Y N %	R N %	B N %
1	1	A												
		B												
		C												
		D												
	2	A												
		B												
		C												
		D												
	3	A												
		B												
		C												
		D												
	4	A												
		B												
		C												
		D												
2	1	A												
		B												
		C												
		D												
	2	A												
		B												
		C												
		D												
	3	A												
		B												
		C												
		D												
	4	A												
		B												
		C												
		D												
3	1	A												
		B												
		C												
		D												

FORM J-2

3	2	A B C D
	3	A B C D
	4	A B C D
4	1	A B C D
	2	A B C D
	3	A B C D
	4	A B C D
4A	1	A B C D
5	1	A B C D
	2	A B C D
	3	A B C D



FORM J-3

5	4	A B C D
	5	A B C D
6	1	A B C D
	2	A B C D
	3	A B C D
	4	A B C D
8	1	A B C D
	2	A B C D
	3	A B C D
	4	A B C D